COURSE DESCRIPTION

Course code	Volume in ECTS credits	Institution	Faculty	Department
MIŠ8002	8	VMU	AA, Faculty of Forest Science	Forest Management and Wood Science

Course title in Lithuanian Miškotyros metodologija

Course title in English Methodology of Forest Research

Study methods	Volume in ECTS credits
Lectures	4
Consultations	1
Seminars	1
Individual work	2

Short course annotation in Lithuanian (up to 500 characters)

Kursas skirtas pirmųjų studijų metų doktorantams. Kurso tikslas suteikti doktorantui gebėjimų pasirinkti tinkamus miškotyroje naudojamus mokslinių tyrimų ir statistinės analizės metodus reikalingus konkrečiam mokslo darbui atlikti, kūrybingai juos pritaikyti ir teisingai interpretuoti gautus rezultatus. Doktorantai įgyja kompetencijų naudotis mokslinės informacijos šaltiniais, rengti mokslinių tyrimų metodikas, rinkti ir apdoroti duomenis, analizuoti, įvertinti, apibendrinti ir aprašyti mokslinio tyrimo rezultatus, naudotis statistinės analizės programiniais paketais (Statistica, SPSS, Maple), parengti platinimui ir naudojimui mokslinio tiriamojo darbo kūrinius, planuoti mokslinio tiriamojo darbo projektus
Studijų formos: paskaitos, pratybos, savarankiškas darbas, seminarai ir baigiamasis egzaminas

Short course annotation in English (up to 500 characters)

The course is designed for PhD students of the first year of studies. The aim of the course is to give the doctoral student the ability to choose the appropriate methods of research and statistical analysis used in forest sciences, to perform a specific research work, to apply them creatively and to correctly interpret the obtained results. Doctoral students acquire competencies to use scientific information sources, to develop research methodologies, to collect and process data, to analyze, evaluate, summarize and describe research results, to use statistical analysis software packages (Statistica, SPSS, Maple), to prepare for publishing and use of research works to plan scientific research projects.
Forms of studies: lectures, practicums, seminars, individual work and final exam.

Relevance of the course

PhD students will have sufficient knowledge and skills to analyze, develop and apply research methodologies in forest science, based on applied statistical methods, to produce scientific reports and articles, to plan, organize and carry out forest research work.

Course aims

To give the doctoral student the ability to choose the appropriate methods of research and statistical analysis needed for specific research work, to apply them creatively and to correctly interpret the obtained results and to submit to the global scientific community of forest researchers

Content (topics) and methods

1. Topic Introduction: the concept of science, classification, object, subject; scientific research - concept, classification, object, subject; the results of the research and the forms of their presentation. Study methods: lectures, seminars, exam.
2. Topic Scientific information: information, concept of information system and information ratio, types of information, characteristics of social information; information sources; bibliographic classification of information sources, bibliographic description of information sources; searching for information sources; use of information sources in research work. Study methods: lectures, seminars, exam.

3. Topic Methodology and methods of scientific research: methodology, method, methodic: conception and levels; general research methods; methods of empirical research; methods of theoretical research; experimental (theoretical and empirical) research methods; Methods of metatheoretical research; special research methods. Study methods: lectures, seminars, exam.

4. Topic Research process: experimental research process; types of experiments; formulation of research background; choice of research area and direction; evaluation of the research direction; the state and location of the study at the modern scientific stage; definition of research subject; assessment of the research subject by information sources; formulating the hypothesis of the problem and its solution; preparation of research methodology; preparation of an experimental program; determining the indicators and factors of the survey results; identification the type of an experiment; determination of the scope and number of tests and replications; data outliers and error estimation techniques; Creating an experimental plan; conducting an experiment: collecting, evaluating and processing data; presentation of results; analysis of results (interpretation, discussion) and generalization; formulation of conclusions and proposals. The process of theoretical research; choice of research area and definition of research subject; assessment of cognition of the research subject, generating the main idea of the problem and its solution; formation of concepts and assumptions, raising of the working hypothesis; selection of research methods; accumulation of scientific facts, their analysis, raising of scientific hypotheses; model development and testing, acceptance of hypotheses; Summarizing of the research results. Study methods: lectures, seminars, individual work, exam.

5. Topic Formalization of scientific works: production of scientific research; scientific article; scientific study; scientific monograph; scientific report; Bachelor's thesis; Master's thesis; doctoral dissertation; types of scientific presentation; annotation of scientific works; review of scientific works; publication of scientific works. Study methods: lectures, seminars, individual work, exam.

6. Topic Presentation of research results: forms of oral presentation of scientific information; preparation and presentation of scientific reports; preparation, presentation and defense of the dissertation. Study methods: lectures, seminars, independent work, exam.

7. Topic Organization of scientific work: hygiene of mental work; organization of the research workplace; Cluster of researchers, its formation and work organization; institutional structure of science organization in Lithuania; Evolution of science. Study methods: lectures, seminars, exam. Study methods: lectures, seminars, individual work, exam.

8. Topic Statistical methods: basic concepts; population, sample, variable, variable types and measurement scales, statistics and parameters; sample and sampling types; probabilistic distributions: Binomial, Poisson, Gauss, Student, Fisher (properties, density functions); the necessity and methods of variable transformations; descriptive statistics and errors: central tendency statistics and measures of variation; point estimates and confidence intervals; statistical tests. Study methods: lectures, practicums, individual work, exam.

9. Topic Analysis of variance (ANOVA): one and two factor cases; Background of ANOVA method, theoretical assumptions of ANOVA analysis, statistical criteria; multivariate ANOVA; fixed and random factors; interaction of factors; ANOVA of blocked data; task formulation, data preparation, interpretation of results; examples of use ANOVA in forest research. Study methods: lectures, practicums, individual work, exam.

10. Topic Regression analysis: linear, polynomial and nonlinear regression analysis; theoretical assumptions, checking the theoretical assumptions of the regression model; parameter estimates, their errors and significance; equality of parameters of two regression models; selection of regression model. Multiple regression analysis, assessment of multicollinearity and autocorrelation; applications of linear, nonlinear and logistic regression models in forest research. Study methods: lectures, practicums, individual work, exam.

11. Topic Time series models: time series transformations, smoothing; seasonal decomposition;

autocorrelation, ARIMA model and evaluation of its parameters. Arima model application in forest research. Study methods: lectures, exercises, individual work, exam.

12. Topic Techniques of multi-dimensional analysis: multidimensional data; graphic presentation of multidimensional data; significance tests of multidimensional data; Tests of multidimensional distances; factor analysis; method of principal components, examples of factor analysis in forest research. Cluster analysis; distance and similarity measures, prototypes of clusters; methods of clustering, two step clustering, k-means clustering; hierarchical clustering; hierarchy index; significant number of clusters; applications of cluster analysis in forest research. Discriminant analysis; Fisher model; classification and discriminant functions; canonical discriminant functions; examples of discriminant analysis in forest research. Canonical correlation analysis; multidimensional scaling; ordination; spatial statistics; spatial layout data and it's graphical presentation; examples of canonical analysis in forest research. Study methods: lectures, exercises, individual work, exam.

Structure of cumulative score and value of its constituent parts

Practicums - 25% of the final grade; Individual work - 25% of the final grade; Seminars - 10% of the final grade, Exam - 40% of the final grade.

Compulsory reference materials

No.	Authors of publication, title, publishing house, year of publication.
1.	Čekanavičius V., Murauskas G. Statistika ir jos taikymai I dalis. Vilnius Tev, 2001.
2.	Čekanavičius V., Murauskas G. Statistika ir jos taikymai II dalis. Vilnius Tev, 2002.
3.	Čekanavičius V., Murauskas G. Statistika ir jos taikymai III dalis. Vilnius Tev., 2009.
4.	Kardelis K. Mokslinių tyrimų metodologija ir metodai. Šiauliai, 2007.
5.	Rupšys P., Olson U., Engstrand U. Statistiniai metodai. Kaunas, Akademija, 2007.
6.	Tidikis. R. Socialinių mokslų tyrimų metodologija. Vilnius, 2003.
7.	Venclovienė. Statistiniai metodai aplinkotyroje. Kaunas, 2008.
8.	Venclovienė J. Statistiniai metodai medicinoje. VDU, 2010.
9.	Christensen R., Analysis of Variance and Regresion. Applied Statistical Method. N Y, Chapman & Hall, 1996.
10.	Rienecker L., Jorgeksen P.S. Kaip rašyti mokslinį darbą. Vilnius, 2003.
11.	Cochran W.G. Sampling Techniques. John Wiley & Sons, 1972.
12.	Crewson Ph. Applied Statistics Hanbook. AcaStat Software, 2006.
13.	Kanji G. 100 statistical tests. SAGE Publications Lt. , 2006.
15.	Smith M. Statistical Analysis Hadbook. The Winchelsea Press, Drumlin Security Ltd, Edinburgh, 2018.
16.	Sioptani M., Hayakawa T., Fujikoshi Y. Modern Multivariate Statistical Analysis: A Graduate Course. Handbook, American Sciences Press, Inc., 1985.

Supplementary reference materials

No.	Authors of publication, title, publishing house, year of publication.
1.	Bartasevičienė V. Ekonominė statistika. Kaunas, 2005.
2.	Liutikas V., Šeštokas J., Zujus J. Mokslinių tyrimų pagrindai, Vilnius, 1987. 223 p.
3.	Mažeika J. Mokslinės ir technologinės kūrybos metodologiniai pagrindai. Akademija, 2007.
4.	Nekrašas E. Filosofijos įvadas. Vilnius, 2004.
5.	Plečkaitis R. Logikos įvadas. Vilnius, 2005.
6.	Sakalauskas V. Duomenų analizė su STATISTIKA. Vilnius, Margi raštai, 2003
7.	Songailienė A., Ženauskas K. Tyrimo duomenų biometrinis vertinimas. Vilnius, 1985.
8.	Day R. A. How to write and publish scientific paper. Philadalphia,1979.
9.	Manly B. F. J. Multivariate statistical methods. London, 1995.

Course programme designed by

No.	Name, surname	Institution	Degree	E-mail address
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